

## Project Support

Support all applicable instrument meetings and design reviews including but not limited to: Technical interface meetings, Design reviews, pre-test reviews, status meetings, Pre-environmental reviews, Pre-ship reviews, etc. Provide recommendations to the project. Support clean room operations for integration and test of the L'Ralph instrument. Implement contamination control approach and verify that appropriate practices are being employed and contamination requirements are being achieved. Review/write applicable contamination related documents including: Contamination Control Plans, Cleaning and Operating Procedures, Purge specifications, Bake-out Procedures, and Launch Site Contamination Control Plans. Document all reviews of contamination related documentation. Deliver recommendations to the project. Advise and assist instrument with overall contamination requirements and implementation. This task may involve travel to spacecraft or instrument provider facilities and the launch site. Travel in support of this task to other locations may also be necessary

## Contamination Analytical Support

Develop and update analytical contamination models for L'Ralph instrument, as necessary. Predict the amount of contaminant that will impinge on the spacecraft and instrument surfaces given the applicable in-flight environment. Perform thruster impingement analyses, in-flight outgassing analyses, thermal vacuum test analyses, venting analyses, conductance analyses, particulate re-distribution analyses, and other contamination related analyses as required by the project. Using results, develop outgassing certification rates and verify instrument requirements are achievable. After completion of all analyses, provide, as a minimum, reports explaining theory, assumptions, and results. Also provide computer files containing geometric model, view factors, sticking coefficients, inputs, and results.

## Contamination Thermal Vacuum Testing

Perform space environmental testing of flight, flight spares, ETU, and/or GSE hardware and materials for the L'Ralph instrument, utilizing the GSFC on-site vacuum testing facilities and laboratories including Code 545 run thermal vacuum chamber support or other approved, external testing facilities for optical, structural, or mechanical evaluation in a space environment. Space environmental testing for contamination will primarily include outgassing related measurements and bakeouts, but may also include testing of solar wind facility exposure, UV exposure, ESD evaluations, thermal cycling, thermal shock, vacuum resistivity measurements, thermal conductivity and chemical decomposition in the presence of space environmental components such as atomic oxygen, mechanical strength and wear resistance.

Contractor shall generate a test plan when directed by the project and shall submit a space environmental test report after completion of test.

Perform general maintenance to maintain upkeep of the GSFC on-site space environmental testing equipment and facilities (such as: vacuum chambers, instrumentation, solar simulators, etc.).

## Laboratory Services

Contractor shall supply materials and equipment to take and analyze particle fallout monitors (ie Silicon wafer fallout plates) to be exposed in and around L'Ralph hardware.

Contractor shall evaluate the particle fallout characteristics for materials which may pose a threat to L'Ralph hardware cleanliness requirements. Procurement of test material may be required if not provided by the project.

Contractor shall provide extracted NVR swabs/wipes when necessary for testing of flight hardware to evaluate the cleanliness level of the specified hardware. Analysis of these swabs will typically be performed by the GSFC materials branch, but detailed extraction data and process may need to be Provided.

## Thermal Coatings Support

Review, select and recommend thermal control coatings and materials for space application to address flight projects needs. Provide support to and participate in meeting of the GSFC Coatings Committee, as needed. Assist with the determination of beginning-of-life (BOL) and end-of-life (EOL) thermal radiative property predictions of thermal control coatings and surfaces based on specified mission parameters, laboratory testing and space flight data. Participate in discipline (thermal, contamination, and mechanical) peer reviews and project design reviews. Attend and participate in project related meetings, on and offsite, as required. Author any new (or revise any old) specifications, design reports, work instructions, QA documentation, or drawings pertaining to project thermal coatings or other hardware/documentation as directed by TM. Procure thermal control coatings and associated materials such as Z93P, Z93C55, and silver Teflon coatings to support development, qualification, and project support efforts or as directed by the TM.

## Thermal Coatings Testing

Perform thermal coatings or MAC coatings application and thin film deposition on flight hardware, ETU, and GSE structures in GSFC on-site coatings facilities, utilizing GSFC coatings thermal vacuum systems and spray booths for L'Ralph. Perform thermal coatings application and depositions on test coupons and hardware for development of project flight hardware. Perform touch- up and repair of coated flight hardware and surfaces, as requested. Perform general maintenance to maintain upkeep of the GSFC on-site thermal control coatings application and thin film deposition equipment and facilities (vacuum chambers, spray guns, spray booth, etc.). Additionally, provide all test support, GSE and facilities for environmental vacuum bake-out testing of flight coating materials and other hardware. Perform thermal-optical/radiative property measurements of flight, flight spares, ETU, and GSE, thermal control coatings and materials hardware and/or development and witness coupons for space application, utilizing the GSFC on- site coatings facilities and laboratories. Perform measurements in accordance with GSFC ISO document 546-WI-8072.1.61, entitled "Absorptance, Emittance, Reflectance, and Transmittance Measurement of Thermal Control Coatings" and calorimetric emittance evaluations and IR reflectance measurements, BRDF, or other established optical procedures/test methods approved by the TM. Generate and submit thermal-optical/radiative property test report within seven (7) days after completion of measurements. Perform space environmental testing of flight, flight spares, ETU, and/or GSE thermal control coatings and materials for L'Ralph, utilizing the GSFC on-site coatings facilities and laboratories including Code 545 run thermal vacuum chamber support or other approved, external testing facilities for optical, structural, or mechanical evaluation in a space environment. Space environmental testing shall include but not be limited to solar wind facility exposure, UV exposure, ESD evaluations, thermal cycling, thermal shock, vacuum resistivity measurements, outgassing related measurements and bakeouts, thermal conductivity and chemical decomposition in the presence of space environmental components such as atomic oxygen, mechanical strength and wear resistance. Modify existing or construct new Code 546 facilities to meet program test requirements. Governing GSFC ISO documents: Guidelines for Selection, Application, Characterization and Testing of Thermal Coatings (546- PG-8700.2.1) and

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L'Ralph Contamination Control & Thermal Coatings

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Requirements for Thermal Design, Analysis, and Development (545-PG-8700.2.1A). Generate and submit space environmental test report after completion of test. Perform general maintenance to maintain upkeep of the GSFC on-site space environmental testing equipment and facilities (such as: vacuum chambers, instrumentation, solar simulators, etc.).